#10/Req. for Recon. 6/4/03 C. Moore

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	**Confirmation No. 2449**
Akira TERAOKA	:	Docket No. 2000-0311A
Serial No. 09/533,778	:	Group Art Unit 2882
Filed March 24, 2000	:	Examiner Hoon K. Song

X-RAY INSPECTION METHOD AND APPARATUS USED FOR THE SAME

REQUEST FOR RECONSIDERATION

Assistant Commissioner for Patents,
Washington, D.C.

Sir:

In response to the Office Action of February 27, 2003, Applicant in the above-referenced U.S. patent application hereby requests reconsideration of the rejections contained therein.

In the Office Action, the Examiner rejected claims 21-32 as being anticipated by Halliday et al., U.S. Patent 5,388,136. The Examiner issued a form PTO-892 citing the Halliday et al. patent.

However, it is noted that the Halliday et al. patent had in fact been previously made of record by the Examiner in the Office Action of November 6, 2002. At that time, the Examiner stated that the prior art, including Halliday et al., which was then used to reject now canceled claims 33-34, did not disclose a method of X-ray inspection of a section of a sample that includes swinging the X-ray device in translational motion about a straight line as an axis, the straight line lying in a plane of the section of the sample, while maintaining an incidence plane of the X-ray detecting device parallel to the section of the sample. The Examiner further stated that the prior art does not disclose an apparatus for an X-ray incidence plane arranged to be parallel to a straight line, and a swinging means for swinging the X-ray detecting device in translational motion about the straight line as an axis while the X-ray incidence plane is maintained facing in the same

direction. It is respectfully submitted that the Examiner's previous conclusions regarding the applicability of Halliday et al. are correct, and this will be discussed in detailed below.

Thus, Halliday et al. in fact neither discloses nor suggests the features of either independent claims 21 and 25. Turning to Figure 6 of the present application, and noting the discussion of Figs. 6-8 beginning at page 4 of the substitute specification, an X-ray source 11 and an X-ray detecting means 12 are arranged so as to face each other with a sample 13 between. An X-ray incidence plane 12a of the X-ray detecting means 12 is maintained parallel to the section 13a of the sample 13 so that points in the section 13a are projected at corresponding points in the X-ray incidence plane 12a. The X-ray detecting means 12 is swung or orbited about a straight line L_1 as a central axis with a parallel relationship between the X-ray incidence plane 12a and the section 13a being maintained. The X-ray source 11 is rotated or pivoted about the straight line L_1 as an axis of rotation or pivot axis in synchronization with the X-ray detecting means 12. By this operation, the X-ray source moves between points g and G and the X-ray detecting means 12 moves while maintaining a position that is parallel to itself between positions h and H. By this process, when a printed circuit board 2 on which a BGA 1 is mounted, noting for example Fig. 2, is placed on the stage 14, a sectional image that includes the straight line L_1 and having a parallel relationship with the X-ray incidence plane 12a as for example shown by Fig. 5 can be obtained.

Turning to Fig. 10, it may be seen how a control means 17 controls the rotating means 15 for controlling the X-ray source 11 to rotate about an axis S of rotation. At the same time, the control means 17 controls a swinging means 16 for controlling the X-ray detecting means 12 to move in translational motion about the axis S.

Neither the method nor the apparatus of the present invention is disclosed by Halliday et al. Halliday et al. is indeed concerned with providing a computerized system for programmable, high resolution X-ray inspection of manufactured electronic items. However, the structure and process provided by Halliday et al. is quite different from that of the present invention as represented by claims 21 and 25.

In the rejection, the Examiner primarily referred to Figure 1, and the axis Z. The Examiner further alleged that Figure 1 disclosed swinging the X-ray detecting device in

translational motion about a straight line as an axis, referring to the Z-axis, the straight line lying in a plane of the section of the sample, while maintaining an incidence plane of the X-ray detecting device parallel to the section of the sample. The Examiner further alleged that Figure 1 disclosed rotating the X-ray source about the straight line in synchronization with the swinging of the X-ray detecting device. However, none of this appears to be disclosed in Halliday et al.

As discussed in column 2 of Halliday et al., X-ray sources 12 and X-ray detectors 13 have a table set 11 positioned therebetween. The electronic device to be inspected is loaded onto the table set 11, which can move in the plane where it lies. The movement of the table set having the electronic device loaded thereon is controlled by a master computer 14. Each of the X-ray sources is mounted on a radially movable slide 15 controlled by the computer 14. The detectors 12 are also mounted on radially moving slides 16, also controlled by the computer 14. Each detector is positioned to intercept X-rays after passing through the electronic device and each detector is associated with a particular angle of illumination.

Column 3 of Halliday discusses the operation of this system. As noted, the X-ray sources, designated 23 in column 3, and the detectors, designated 25 in column 3, can primarily move radially. They are also indicated as being permitted to move orthogonally with respect to the circles.

As noted beginning at line 43, in operation, in order to realize a cross-sectional image, information is gathered from eight 45° angle offset source/detectors to eight image boards, with each image board corresponding to one source and detector. The eight images are combined with a logical "AND" on a certain grey level value to master video RAM in order to give an image similar to a tomographic image. This technique smears out all unwanted data and individual images and it highlights in-focus data. As noted, the system has a lack of continuity with respect to continual rotation acquisition laminography, and thus uses a convolution process in order to smooth the differences between the discrete images.

Comparing this system with claim 21, it is noted that one requirement of claim 21 is swinging the X-ray detecting device in translational motion about a straight line as an axis, with the straight line lying in a plane of the section of the sample, while maintaining an incidence plane

of the X-ray detecting device parallel to the section of the sample. There is no disclosure or suggestion of "swinging" any of the X-ray detectors 13 of Halliday et al. contained in Halliday et al. Rather, only radial and orthogonal movements are disclosed. There is no discussion of swinging, nor any means for swinging disclosed. Furthermore, there is no disclosure or suggestion of maintaining an incidence plane of the X-ray detecting device parallel to the section of the sample. Furthermore, the Examiner refers to axis Z. However, there is no disclosure or suggestion that the axis Z would lie in the plane of the section of the sample.

Looking at the next step of claim 21, Halliday et al. clearly does have X-ray sources 12 that would apply X-rays to the sample. However, there is no disclosure or suggestion anywhere in Halliday et al. of rotating the X-ray source about the straight line Z. Nor is there any means disclosed for doing such.

Accordingly, it is respectfully submitted to be clear that Halliday fails to disclose or suggest claim 21.

Noting claim 22, there is no indication of the section of the sample being vertical to the stage 11 in Halliday et al.

Noting claim 23, there is no indication in Halliday et al. of the sample being placed on the stage so that the section of the sample is out of vertical to the stage. There does not appear to be any discussion of how the electrical component is provided on the stage 11.

Noting claim 25, as noted above, Halliday et al. provides X-ray sources and X-ray detecting devices. And a sample can be placed between them so that X-ray is emitted from one source can pass through the sample and be detected by the X-ray detecting device.

However, as also noted above, Halliday et al. does not disclose or suggest a swinging means for swinging the X-ray detecting device in translational motion about the straight line as an axis while the X-ray incidence plane is maintained facing in the same direction. Halliday et al. neither discloses any swinging of the detecting device, nor maintaining the plane facing in the same direction during such swinging, i.e. translational motion.

Nor does Halliday et al. disclose or suggest any rotating means for rotating the X-ray source 12 about axis Z as an axis of rotation in synchronization with the X-ray detecting device.

There is no discussion of any such rotation. As noted, the only discussion of movement of the sources 12 and detectors 13 is radially by suitable mechanisms, and orthogonally to the circle in which they lie. There are no means for swinging or rotating discussed anywhere in the patent.

Similar comments as above apply to dependent claims 26 and 27. Furthermore, noting claim 30, Halliday et al. does not appear to disclose or suggest any sliding mechanism for sliding the X-ray detecting device in a direction perpendicular to the X-ray incidence plane. There is no discussion whatsoever of the X-ray incidence plane in Halliday et al., it appears.

From the above, it is respectfully submitted to be clear that the Examiner has failed to establish a *prima facie* case of unpatentability of claims 21-32. This is because the limitations contained in each of independent claims 21 and 25 cannot be found in Halliday et al. Should the Examiner maintain this rejection, the Examiner is respectfully requested to specifically point out how Halliday et al. meets such limitation, as a reading of Halliday et al. does not provide any disclosure or suggestion of such features.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance, and the Examiner is requested to pass the case to issue. If the Examiner should have any comments or suggestions to help speed the prosecution of this application, the Examiner is requested to contact Applicant's undersigned representative.

Respectfully submitted,

Akira TERAOKA

By: ____________________

Nils E. Pedersen
Registration No. 33,145
Attorney for Applicant

NEP/krl
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
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